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AND

JOURNAL FOR RECORDING FACTS & ANECDOTES

RELATING TO

QUADRUPEDS, BIRDS, REPTILES, FISHES, ANNELIDES,
INSECTS, WORMS, ZOOPHYTES, &c.

THEIR HABITS, FOOD, RETREATS, OCCASIONAL APPEARANCE,
MIGRATIONS, NESTS AND YOUNG.

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A FAMILIAR INTRODUCTION
TO THE
HISTORY OF INSECTS.

By EDWARD NEWMAN.

PRESIDENT OF THE ENTOMOLOGICAL SOCIETY OF LONDON,
MEMBER OF THE IMPERIAL L.-C. ACADEMY (NOMINE LATREILLE), FELLOW
OF THE LINNEAN, ZOOLOGICAL AND BOTANICAL SOCIETIES,
&c., &c., &c.

This work is illustrated by a profusion of engravings, executed in the first style of the art, from the author's own drawings on the wood. It is divided into four parts. The *first* gives a detailed account of the habits and manners of the most interesting insects, and a description of their wonderful transformations. The *second* treats of capturing, killing and preserving insects, and of constructing cabinets; the most ample details are given, and the author has taken especial pains to explain the most expeditious modes of killing insects, in order to inflict no unnecessary pain on the insects themselves, and also to save the feelings of the humane and kind-hearted, which are too often outraged by the modes in common use. In the *third* part the author describes, in an easy and popular manner, the structure of insects, using language which all may understand, yet never deviating from scientific accuracy: he has written for the public at large, and not for that learned but limited portion of the public to which the works of modern entomologists are exclusively addressed. The *fourth* part gives a sketch of the classification of insects; and the work concludes with an Alphabetical Index, each technical word having an explanation as well as reference.

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"This is a capital introductory work: a rare example of a teacher being thoroughly master of his subject, even in the most minute details, and yet condescending to instruct those who are on the very threshold of inquiry, a duty generally entrusted to the quack and the compiler."—*Westminster Review.*

JOHN VAN VOORST, PATERNOSTER ROW.

On the Food of certain Gregarious Fishes.

By R. Knox, M.D., F.R.S.E., &c.*

At an early period of my inquiries into the natural history of the Salmonidæ, I was much struck with the difficulty there seemed to be of arriving at the truth in a matter so simple in appearance as the determination of the food on which certain interesting gregarious fishes live and thrive. The conflict of opinions on this point which then existed, and strange to say still exists, induced me to devote a good deal of attention to it; and as I find my views still opposed to many, and especially to those of my esteemed and distinguished friend M. Valenciennes, I have thought it might serve the cause of science and of truth to submit a memoir on the subject to a society, venerable as well by its name as by the services it has rendered the sciences of observation.

The inquiries, of which the results are merely given here, were commenced about 1824, or about thirty years ago; and although I have repeated them on many occasions, I do not find it necessary to alter or modify the statements originally made on this point to the Royal Society of Edinburgh, in whose 'Transactions' a mere notice of my researches and observations were published.

My attention was first directed to the fact, for such it is beyond a doubt, that in the stomachs and intestines of fresh-run salmon, that is, of salmon fresh from their best, indeed their only true feeding-ground, the unknown recesses of the ocean, nothing is ever found but a peculiar reddish substance (and that in small quantity), unlike anything known to possess life. The reddish coloured matter is also found in the intestine. On applying to practical fishermen, that is, to those who had seen, I shall not say examined, hundreds of salmon opened and gutted, I found that they had but one opinion on the subject, namely, that the food of the salmon, whilst a resident in the ocean, was altogether unknown.

On inquiring of the same class of persons as to their knowledge of the food of the herring, I found them equally at fault. They spoke vaguely about the herring living by suction, but they were agreed as to the main fact, namely, that food discernible to the naked eye was rarely to be found in the stomach of the herring. Whilst reflecting on

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* Read December 19th, 1854, to the Linnean Society. Communicated to the Linnean Society by William Yarrell, Esq., V.P.L.S.

BRITISH MUSEUM

these circumstances, so singular in the natural history of fishes playing an important part in the economic history of Great Britain, Holland, and the Scandinavian nations, I learned accidentally that in South Scotland, in a lake or lakes near Lochmaben, there was, in great abundance, a small gregarious fish, which could not be tempted by any bait, and whose food was entirely unknown. These lakes, of various extent and depth, are situated at no great distance from the river Annan, with which they all communicate directly or indirectly, but not all with each other; they contain many kind of fish, as the vendace, of whose food I am about to speak, which are not found in the river Annan; neither am I aware that the salmon and sea trout, which, at certain seasons, abound in the river, make their way into these lakes. Thus many curious questions are opened up for the consideration of the philosophic naturalist. The jack or pike abounds in the Castle Loch, and yet has not destroyed the vendace, a fish not found, so far as I know, in any other part of Britain. With the food of this fish, the vendace, I resolved to commence the inquiry. Confined to certain lakes, and never quitting these, abiding in waters which I could command with the net, the property of gentlemen whom I had the pleasure to call my friends, I felt that the inquiry ought to commence there. The facts, moreover, were reported as being, *without exception*, an important point in every physical inquiry. Far otherwise, I saw, would be the inquiry into the food of the herring and salmon; questions surrounded by numerous difficulties, and overlaid with prejudices, extending even to the naturalist.

The mass of mankind love mystery now, as they once did anything which bore the semblance of a miracle. This foolish and silly passion can only be met and stemmed by philosophy, by science. The case between the lovers of mysterious untruths and truth-seeking science has been well stated lately by the illustrious Faraday. In the matter of the food of the vendace of Lochmaben, a gregarious fish, now arranged by naturalists with the Corregoni, I found, on reaching the village of Lochmaben and its pleasing lakes, many vague and mysterious stories afloat as to the vendace, which even naturalists had taken the trouble to repeat. One forenoon's inquiry destroyed the whole illusion or delusion. Dozens of the vendace were opened immediately on being removed from the lake, by means of nets, for they are not to be caught in any other way: on their stomachs being examined they were found to be crammed with thousands of Entomostraca, or microscopic shrimps as they may be called, the class of microscopic shell-fish so beautifully described by Müller. The solution of the mystery depended simply on the placing a portion of the contents of the stomach under a strong lens, which I took care to be provided with. Strange as it may seem, nevertheless, the fact is certain, and now I believe admitted by all, that no one had ever thought of this before.

The species of the Entomostraca first discovered belonged to the genus Lynceus, but several other genera were observed; and in winter (14th December, 1832, for I had the lakes fished expressly for this inquiry), the Cyclops of Müller of several species most abounded. Thus, instead of living on air and water, the vendace consumes daily, no doubt, thousands of shell-fish a highly nutritive food; the roe of these Entomostraca, being swal[illegible]d with the parent, contributing to render the food still more nutri[illegible]

The mystery was now at an e[illegible] have sometimes thought that the villagers were not over well pleased at so simple a solution of what they had so pleasantly and so frequently discussed. A dissenting clergyman of the place wrote an article against my views, or rather against myself, which article was published in a work * so replete with error as to stand, I believe, unparalled in the history of compilations. Another parson,† a man of common sense and fond of science, recommended the dissenter to see me *first*, and examine with me *the food* of the vendace, for himself; in other words, "to test the fact by an appeal to the materials." This he declined doing, for reasons I need not state. The contempt of the class I speak of for physical truths is extreme, but this lamentable frailty, so detrimental to the best interests of mankind, does not fortunately extend to all theologians.

This unlooked for discovery opened up at once a vast field of inquiry; in fact I commenced with the vendace knowing the difficulties which awaited its extension to some other gregarious fishes larger than the vendace, that is, the herring, the early spring trout of Loch Leven, and the char.

Before proceeding to these, I shall allude to several facts made out as to the natural history of the vendace, facts ascertained during the course of frequent journeys to Lochmaben; they may be useful to the naturalist who may hereafter more fully describe the Corregoni. The notion that, like the herring, the vendace dies immediately on being removed from the lake was disproved at once, by bringing them to the village in buckets of water: it is by no means a very delicate fish, and could easily be transplanted to other lakes; but it is not a high-seasoned fish, and in this respect also what has been said of its singularly good qualities is a pure exaggeration. The object of science is to destroy mystery and popular delusions.

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* 'The Statistical Account of Scotland.' Blackwood.

† Dr. Macknight.

Mr. Harkness, of Lochmaben, who assisted me greatly in these inquiries, had the kindness to have the vendace caught for me in the depth of winter, that is, on the 16th of December. The rivers Annan and Æ were fished for me on the same day for parr, and specimens of both were sent me. There were twenty-four vendace; of these twenty-two were females and two males; they were taken in the Castle Loch of Lochmaben, as usual with the net. In nineteen of the female vendace the ovaries were small, very soft, and the ova mere points; but the fish themselves were in good condition: in three females the ova were very large, and the fish just about to spawn; in the two males the milts were progressing in size, but not much enlarged.

The vendace is found in two of the system of lakes near Lochmaben, namely, the Castle Loch, so called from the ruined castle of the Brus on its banks, and the Mill Loch: this latter is a deeper loch, but not so extensive. As it seemed to me that the vendace of the two lakes differed somewhat from each other, my brother, at my request, examined them very carefully; the result of that inquiry is as follows:—

Examination of the Vendace of the Castle Loch and Mill Loch, February 26, 1837.

"The mouth being fully closed, and the specimen laid on a flat board, the following dimensions were taken:—

	Castle Loch.			Mill Loch.		
Snout to centre of tail	$6\frac{3}{4}$ inches.			$6\frac{3}{4}$ inches.		
„ dorsal fin	3 „			3 „		
„ mort fin	$5\frac{1}{8}$ „			$5\frac{1}{8}$ „		
„ pelvic fin	3 „			3 „		
„ anal fin	$4\frac{3}{4}$ „			$4\frac{3}{4}$ „		
„ extremity of gill-covers	$1\frac{3}{8}$ „			$1\frac{1}{2}$ „		
Breadth of eye	$\frac{3}{8}$ „			$\frac{3}{8}$ „		
Length of head, dorsal line	$1\frac{1}{16}$ „			$1\frac{1}{8}$ „		
Greatest depth of body	$1\frac{5}{8}$ „			$1\frac{3}{4}$ „		
	oz.	drs.	grs.	oz.	drs.	grs.
Weight	1	5	40	1	9	40

"Lateral line precisely mesial in the Castle Loch vendace, but one-eighth nearer the dorsal line than the abdominal line in the Mill Loch.

"A section shows both these specimens to be female, with the ovary more fully developed in the Mill Loch vendace; the liver is evidently larger in the vendace of the Mill Loch: these differences, however, will not account for the great additional weight of 4 drs., and which evidently arises from the greater depth and thickness of the Mill Loch vendace. This greater depth and thickness of the body, and the larger head, seems to me to constitute the only specific differences between these two fishes. The difference in colour is very striking; but this seem to me to depend on the greater number of minute black spots of the rete mucosum in the Mill Loch vendace: the dark shade is so strong on the head as to obscure almost, if not entirely, the brain; and thus the peculiar and much-dwelt-on heart appearance observed in the Castle Loch vendace is not seen in that of the Mill Loch. The scales, which I took from the lateral line and near it, of both specimens present precisely the same appearance when placed under the microscope: I counted 30 rays on that part of the scale, in both specimens, which is exposed: the number of rings on the part concealed by the superimposed scale is greatly more."

The largest vendace I have ever seen was 9 inches in length.

Another delusion in respect of the vendace was the supposition that the males lived apart from the females in deeper water, and hence beyond the reach of the net. Like everything else in the history of the fish this also seemed a delusion; for the net being drawn in the Castle Loch of Lochmaben, and near the castle, in presence of Mr. Murray and myself, of fifteen vendace which I examined nine were females and six males: this was in October. Nevertheless, I feel disposed to think that the males are not so numerous as the females, for of forty taken in the Mill Loch at one time only two were males. The males are lighter coloured than the females.

(Thus terminated a popular delusion which had no doubt maintained its ground for centuries. The discovery of the food of the vendace, and of countless millions of other fishes to be spoken of immediately, was a gift of the microscope to science: it illustrates and perhaps explains many obscure points in the natural history of such fishes, and may one day lead to important results.—*Added to the original MSS. April* 20, 1855.)

The Food of the Char.

Having thus successfully solved the problem as to the food of the vendace, and removed all doubts from even the most prejudiced, I next turned my attention to that of the char. Some fine specimens were obtained from Windermere, and the food, which proved to be the Entomostraca, with which the lakes abound, was exhibited to the Royal Society of Edinburgh. The char is a gregarious, deep-swimming fish, shy of taking any bait; nevertheless, it will rise to a fly, and the common food of the trout may be found in its stomach, although I have not found it to be so; nevertheless, it does not seem to me to feed exclusively on the Entomostraca, although these unquestionably form by far the larger portion of its natural food.

The observations as to the food of the char were repeated several times, and always with the same results.

(The disappearance of the char from many lakes in Scotland, as for example, from the lake of Leven, may be connected with circumstances dependent on the natural history of the Entomostraca, which, no doubt, form its natural food.—*Added to the original MSS. April 20, 1855.*)

The Early Spring or Gray Trout of Loch Leven.

I had remarked many years ago that certain trout of Loch Leven come into season much earlier than others; that there were some, in fact, which were in the highest condition in the end of December, January, February and March, a period of the year in which all other descriptions of trout are worthless as food for man. I at first conjectured that this peculiarity might depend on a specific distinction, and I am still disposed to believe that in Loch Leven there are two distinct species of lake trout, an early fish and a late one, but anatomical investigation has not as yet borne out this view. But be this as it may, the facts remained simply as they were,—namely, that an admirable sort of trout comes into perfect condition in Loch Leven as early as December and January; and then came the question of its food.

In January, 1832 or 1833, I requested two friends* to be present at the examination of *four* specimens of very fine Loch Leven trout, purchased in the market that morning. On their stomachs being laid open and examined with a lens, they were found to be filled with Entomostraca; and these I have always found to constitute the food of the early spring trout of Loch Leven.

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* The late Mr. William Murray, of Henderland, and Mr. Graham, of Redgorton, nephew to Lord Lynddoch.

During the remainder of the year the ordinary Loch Leven trout live on the small Buccinum and the common food of trout, with which the lake abounds: they rise readily at an artificial fly, and may, no doubt, be taken with worms or minnows, or any of the ordinary bait for trout.

It has been asserted, since these discoveries were made, that the Entomostraca form the staple food of most of the finer sorts of lake trout. I believe the statement to be very probably correct, but I have not myself had an opportunity of verifying the fact. Those who doubted all these facts at first went soon afterwards, on finding they could not be refuted, into the opposite extreme, and asserted that the Entomostraca, of which, by-the-bye, they had no very clear idea, formed the most nourishing food of fishes. I lay no claim to such sweeping generalizations, being simply contented with what I can prove by demonstration.

The Herring.

Having thus cleared the way, as it were, of some of the obstacles to the successful prosecution of the inquiry, I next proceeded with that of the food of the herring. The difficulty was to obtain the herring from the deep sea, in fine order and as remote as possible from its spawning condition. When found near the coasts, the herring is either about to spawn or has already spawned: it is, to a certain extent more or less, a foul fish, and the food it may take at that time is not to be held to be its natural food; this can only be made out in the herring when in the finest order and in the deep sea, to which he seems annually to retire. This part of the inquiry was accompanied by a good deal of trouble and considerable expense: the herring had to be examined on both coasts of Scotland, and indeed under a variety of circumstances.

Of the hundreds and hundreds of herrings I have examined, with this view, I remember but a very few in whose stomachs anything was found excepting Entomostraca of various species. Of the specimens to which I allude as having been feeding on other prey, one had been living on sand-eels; another on what appeared to be small herrings; and in the stomach of the third were the shells of about a dozen small Buccinums. These were the only specimens out of hundreds in which the Entomostraca did not form the sole food. I leave the negative and positive evidence to speak for themselves. The positive evidence I at last obtained on this curious point would fill a volume.

Throughout the inquiry, which was prolonged for several years, my great object was to obtain the herring at as great a distance from the shores as possible and in the best order. The British herring-fisheries are in reality shore-fisheries, or nearly so, and the herrings are most frequently taken on the spawning-ground, and in a condition when the fish do not feed. Notwithstanding these innumerable difficulties, it seems to me that I have succeeded in determining, beyond all doubt, the food of the herring to consist of various species of Entomostraca, with which it is known the seas and bays abound.

When near the coast the herring is frequently not feeding. Thus, in the Forth, in January and February, 1836, I examined the stomachs and intestines of a very great number of fresh herrings, taken in the Frith of Forth, and found them empty. The roes and milts were large, but not remarkably so. On the other hand, after spawning, and whilst close to the shores, they seem to take to other food, as sand-eels and shrimps. I find in June, 1831, that herrings taken off Dunbar were in this state; the stomach and intestines loaded with putrescence; the fish worthless and insipid. My journals of observations, made by my brother and myself, at every season of the year and on both coasts, are now before me: they confirm the facts, already well-established by practical men, that shore-fisheries of fish whose habitat is the deep sea seldom produce fish in their prime condition. The deep sea cod and haddock, as compared with the same fish caught high in estuaries, furnish a good example of this truth; the herring another. Thus, in the Frith of Forth fishings of the 20th of July, 1834, five male herrings, taken at random from a large number, were found to have the milts small; they had been feeding on the Entomostraca alone: these herrings proved of good flavour and were excellent to eat: thirty others of the same take were found to be insipid and worthless. Of these some had been living on sand-eels as well as Entomostraca; their stomachs and intestines were full of putrescent remains. Thus food, as well as their approach to the spawning or recently spawned state, exercises a striking influence on the quality of certain fishes as food for man.

In August some fine herrings were examined in Glasgow (west coast of Scotland); the food appeared to be the ova of some testaceous animal, as the shrimp, but after all, was probably merely Entomostraca, exceedingly minute: nevertheless, a few even of these herrings had been eating the sand-eel. On this coast also, as the herrings get out of order, they take to other food and become insipid and worthless. These observations were repeated on September 27th and October 13th, 1834, at Anstruther, in Fife, and close to the mouth of the Frith of Forth. Of fifteen herrings taken on July 6th, 1838, of three different sizes, the stomachs were filled with Entomostraca: the first were in good order as food. But in winter, in friths, they do not seem to feed; as on February 6th, 1836, of many fresh herrings caught in the Frith of Forth, the stomachs and intestines were found to be empty.

Of fifty herrings examined on the 13th of February, 1836, caught in the Frith of Forth, forty-two had the stomachs and intestines empty; four had been feeding on the ova of small fishes, and four on a peculiar red substance: in twenty-two others nothing was found. Thus, when caught in bays and friths, the stomach is often quite empty; like the salmon, they are then off their feeding-ground, which is the deep sea. The sexes are usually in equal numbers. On the 30th of November, 1834, my brother remarks, in his journal, that it has been invariably in herrings caught off the Isle of May that he has found the Entomostraca: further up the frith, their stomachs are very generally empty. The Isle of May is close to the German Ocean. On the 4th of December, some herrings taken even now are good; and this, my brother remarks, is invariably the case with the first taken—even in winter.

Continuing the examination of these original journals, I find the following entries:—

"July 6, 1838. Fifteen herrings, taken off Anstruther and dissected, gave the following results; the date of capture as above.

Largest size.—From snout to centre of tail . . .	10⅜	inches.
Length to dorsal fin	5⅛	„
„ to extreme margin of gills . .	2⅛	„
Greatest depth	2⅜	„
Weight	8 oz.	

Middle size.—Measured as above		8⅝	inches.
Ditto	”	4⅛	”
Ditto	”	1¾	”
Ditto	”	1⅞	”
Smallest size.—Measured as above		7¼	”
Ditto	”	3⅝	”
Ditto	”	1½	”
Ditto	”	1⅝	”

“The results of the dissection of these three sorts were as follows:—

“1st examined, was in good order, fat; a male: milt small; 3 inches long by ¼ inch broad: food Entomostraca.

“2nd, a male; in most respects as preceding: food Entomostraca.

“3rd, a male; as above: stomach empty; intestines clean and quite empty.

“4th, in fine order, as above; a male: food Entomostraca.

“5th, a female; in all other respects as those already examined: food, 1st, Entomostraca, abundant, minute; 2nd, two small prawns.

“6th, a female; in other respects as above: food Entomostraca, of two kinds; one extremely minute.

“7th, a female; the fish in the highest order: food Entomostraca.

“8th, a male, 9½ inches long: milt longer than in those described; 4 inches long by ½ inch broad: food Entomostraca.

“9th, a male; as in the first seven: food Entomostraca.

“10th, a female; in the best order: food Entomostraca.

“11th, ditto; ditto: food Entomostraca, of a large species and greenish colour.

“12th, length 7 inches; of very inferior quality, soft; seemingly a young fish, yet tolerably fleshy; a female: food Entomostraca.

“The 13th, 14th and 15th specimens were in as good condition seemingly as those described, but although taken early this morning the viscera by 5 P.M. were found to be putrescent: food Entomostraca.

“Thus, the quality as to food of the natural family of the Clupea depends—1st, on species; 2nd, on their food; 3rd, on their condition as to the state of the milt and roe. Their natural habitat is the deep sea, where they find their natural food—the Entomostraca.”

Lastly, I availed myself of the assistance of my much esteemed friend and former student Mr. Henry D. Goodsir, now, alas! with Sir John Franklin. This gentleman with his more celebrated brother, Mr. John Goodsir, were my favourite students and assistants in my comparative anatomical pursuits, in consequence of their fondness for such studies. Their family resided at Anstruther, a great fishing station on the Frith of Forth, and I wrote to Mr. Henry D. Goodsir to push the inquiry for me to the utmost: this he did by embarking in the fishing-boats himself on the stormy frith, and proceeding with the fishermen to the fishing-ground, not far from the Isle of May, and in the open sea. He wrote me two letters in answer to my inquiries, one of which, I fear, has been lost; I transcribe a copy of the second; of its value I need say nothing:—

Copy of Mr. Goodsir's Letter respecting the Food of the Herring.

"Anstruther, June 15, 1843.

"My dear Sir,—I have put off thus long in answering your letter of the 29th ult. for the purpose of making further observations on the herring and its food, and find that my previous observations are quite correct in regard to the matter. I will now, then, answer your queries separately.

"1st. The Entomostraca are at certain seasons the almost exclusive food of the herring: there can be no doubt, either, that they follow shoals of these Crustacea to prey upon them, for it is only when the latter make their appearance on this coast that the former are seen; and when their food is most plentiful the herring are in best condition. It is during the summer months also that we find the larvæ of the more common species of Decapoda, along with those of Balani, and occasionally a minute shell-fish, amongst the contents of the stomach.

"2nd. It appears to be chiefly during the winter and spring months that the herring take other kinds of food than the Entomostraca; during these months, however, we find the stomach oftener empty, and only occasionally filled with the larger Crustacea, such as the shrimps, &c.; in other cases with Entomostraca.

"3rd. As to Entomostraca being the partial or exclusive food of other fish besides the herring, there can be no doubt that during the summer months, when the shoals of Entomostraca, or what our fishermen term *maidre*, are in great abundance, they form the food of a great number of other animals besides the herring. The common coal fish is perhaps the species which, next to the herring, preys on the *maidre* in greatest number, and is consequently often caught in large quantities in the nets during the early part of the season.

"It appears to me also that the shoals of Cetacea which make their appearance in the frith during the herring season are in pursuit of the *maidre*, and not of the herring, as is most generally thought to be the case.

"If you are aware of any other points which would require observation, be so good as let me know.

"Believe me most sincerely yours,

(Signed) "H. D. Goodsir.

"To Dr. Knox."

Thus, after the lapse of nearly twenty years, a student of my own, favoured by his position, confirms, to an extent I had scarcely hoped for, my original observations on the food of the herring. I call the attention of naturalists, and especially of my esteemed friend M. Valenciennes, to these *facts*. As regards man, they are the most important which, next to the capture of the herring, can be brought forward in respect of the natural history of the herring; and they explain certain economic statistics bearing on the great fisheries of Holland, which otherwise were wholly unintelligible. The naval power of the ancient republic of Holland was created and based on a deep-sea herring fishery; the modern herring fisheries of France, England and the Scandinavian States are shore and boat fisheries, of little value as a food-producing employment, and of no value whatever in a naval point of view.

Prior to these researches the difficulty of discovering the food of the herring was proverbial, and had been declared such by all. Soon after my discovery of the food of the vendace, I spoke with that true patriot and most amiable and talented man, the late Sir John Sinclair, on the subject, and he informed me that he had often turned the matter over in his mind, but without coming to any definite conclusions: he put into my hand a pamphlet, by the late Sir Gilbert Blane, entitled 'Reflections on the Present Crisis of Public Affairs,' dated 1831, pointing out to me the following passage:—"There are few problems of Nature in the solution of which naturalists are more at fault than the disposal and *nutrition* of the finny family. It is proverbially true that they prey upon each other; but it is so much even beyond conjecture to ascertain what is the ultimate food of fish, that it is the tenet and belief of some of the most respectable inquirers into this department of Nature, that the last fishes which those next above them make their food have no sustenance but water. The phenomenon of the immense shoals of herrings, and the fact of gold and silver fishes living without any visible food, are some of the grounds upon which they found their doctrine." When I removed from the stomachs of the herring, the vendace, the char and the Loch Leven trout, hundreds of Entomostraca, in the presence of this excellent nobleman, and, placing them under a microscope, convinced him that the popular belief that all or any of these admirable fishes lived by or on suction, or on water merely, or on nothing, as some would have us believe, was unfounded, he was greatly surprised and pleased. Thus was this most difficult problem solved at last. I am aware that there are some, but still, I hope, for the honour of my countrymen, few, who say that the solving such a problem as this is a perfectly simple matter—of no value in science, and scarcely meriting notice; yet strange to say that, in respect of all the fishes enumerated, amongst which we may include the salmon, the problem had avowedly remained unsolved from the earliest recorded period until that of my own investigations. It would seem also that Dr. M'Cullagh gave an early attention to this matter, and conjectured that the herring preyed on the Medusæ; but he made no inquiries into the subject. Lastly, it has been asserted that Leuwenhock had detected Entomostraca in the stomach of the herring. There is not a single passage in the Memoirs of this celebrated observer furnishing the smallest hint for the belief that he ever detected the Entomostraca in the stomach of the herring, and his remarks are as follow:—"After much turning this matter in my thoughts, I had a fancy to know what is the food of this fish (the herring); and for that purpose I inquired of many men used to this fishing, what food they generally found in the stomachs of herrings when first caught, but the constant answer I got from them was that they never found any. At length I met with a merchant who fits out ships for the herring fishery, and from him I learned that in a certain tract of sea near the coast of Scotland herrings are caught, in the stomachs of which are found some kinds of small fishes, but that those herrings will not keep long." "Not content with this," continues Leuwenhock, "I determined to wait for the season when certain herrings are brought to our town, which, as I have heard, are caught in great numbers not far from Amsterdam."

Thus it would appear that to practical men, fishermen, merchants, Dutchmen, who turned over millions of florins and guilders annually from this great staple, the food of that fish by which they lived and throve was itself as unknown *as it is at this day* to the same class of men in Britain; that is, fishermen, who deny that it lives on anything; fishermen who say that it lives upon suction, but without attaching the smallest meaning to the word suction. But Leuwenhock says that he "was not content" with the answers of fishermen and merchants, so he commenced opening the stomachs of some fresh herrings caught in the Zuyder Zee. Failing in all attempts to ascertain the real food of the herring, he came to the conclusion that herrings not only "feed on small fishes and even on their own eggs, but that when urged by hunger they will swallow anything they meet with." This illustrious man, for he truly was so, adopted other theories and hypotheses in regard to the herring: he thought that all herrings were of one year's growth, and that when they once abandoned the coasts they never more returned to them; and, lastly, he concluded that the small fishes on which herrings feed (which, by-the-bye, he admits he could not discover), besides being inconceivably small, "are used but sparingly by the herring."

The Food of the Salmon.

From about midsummer, but more especially with the autumnal floods, salmon and sea trout of various sizes begin to rush up the fresh water streams and rivers: their object in this annual migration is clearly enough made out—they are proceeding to the place of their birth, the original streams in which they first saw the light, there to perform the act of the propagation of their species. As the roe and milt grow the fish get more and more out of condition: from the time it enters the fresh-water rivers it ceases to feed, properly speaking. True, it may be tempted to spring at an artificial fly, or to attack a worm or minnow, in accordance seemingly with its original habits and nature; for whilst it lived as a smolt in the fresh waters the ordinary food of trout was also its food; but from the time it first descends to the ocean as a smolt and tastes its marine food, it never again resorts to its infantile food as a constant mode of nourishment. This great fact, well understood by fishermen and true anglers, Mr. Young, of Invershin, has placed, by direct experiment, beyond all doubt.

But what is the food of the true salmon in the ocean?—that food which he cannot do without?—that food on which relatively all his good qualities depend?

As nothing is ever to be found in the stomach and intestines of the fresh-run salmon but a little reddish substance, I placed a microscope over this substance. After much difficulty I came to the conclusion that it was composed of the ova of some species of the Echinodermata. With salmon, whilst in the sea, this is the constant and sole food: sea trout and hirling also live on it, but they readily take to other food, even in the sea, such as the sand-eel, herring-fry, &c. In fresh-water streams the true salmon does not feed; the sea trout feeds, but does not thrive. The absence of this peculiar food forms an insurmountable obstacle to the localization of the salmon, and even of some kinds of the sea trout in fresh-water lakes.

M. Valenciennes remarks, in his great work on Fishes, that the salmon is "vorace; sa nourriture consiste en poissons; (annodytus tobianis.") There exists not a single fact in the history of British salmon in support of this opinion.

In the absence of positive evidence in respect of the marine food of the salmon various theories have been invented by ingenious men, fishermen, closet naturalists, amateurs, and others, to explain the well-known fact of the seeming emptiness of the stomach and intestines in the high-conditioned fresh-run salmon. These theories require no refutation. Some imagined that the salmon refrained from eating in order to prepare himself for his ascent up the river; we owe this singular fancy to Sir Humphrey Davy. Others imagined that the digestive powers of the salmon resembled a furnace, consuming in an incredibly short space of time all the little fishes they swallow; as the intestines are empty as well as the stomach, they were obliged to assign to the salmon's stomach a power equal to the digestion of indigestible parts, such as the skeleton, lens of the eye, &c. Lastly, some conjectured that the salmon discharges, on being taken, the contents of his stomach; but daily on the Tay at Invershin, and elsewhere, salmon are taken *in large numbers* at a single haul of the seine; I have often seen them so taken. Could such a fact, if true, escape observation? I leave the hypothesis in the hands of the practical fishermen.

In spring, as the spawned fish are descending with the smolts towards the ocean, they may occasionally be tempted with an artificial fly or lob-worm; but as to their *feeding* regularly in rivers, Mr. Young's experiments prove, beyond all doubt, that if they feed they profit nothing by it, losing weight and strength daily during their sojourn in the fresh waters.

*Of the Entomostraca themselves.**

The object of this memoir being simply to establish the fact that many valuable gregarious fishes live, some exclusively, others partly, on the Entomostraca, it is not my intention to say much respecting the minute shell-fish serving as their food. They were first admirably described by Müller and Jurine, and their natural history is tolerably well known. They must be exceedingly prolific, and breed no doubt many times a year: they are abundant in the sea as well as in fresh-water lakes; and it is easy to see, by their numerous remains in the limestone of Birdiehouse, and in the limestone of other quarters, that they played an important, perhaps the same, part in the economy of the ancient world that they do in this, namely, serving as food to countless shoals of gregarious fishes, which abounded then as now in fresh and marine waters.

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* Engravings of the specimens of the Entomostraca first discovered in the vendace and herring will be found in my Memoir presented to the Royal Society of Edinburgh.

The Entomostraca of the Southern hemisphere differ seemingly from those of the northern; there also they serve as the food of gregarious fishes. This was proved by my brother many years ago, in respect of the so-called herring of the Bay of Islands, a gregarious fish abounding in these seas, and living on Entomostraca.

To the minuteness, and, indeed, microscopic character of the Entomostraca, must be ascribed the fact of their having so long escaped the notice of naturalists and others, and causing even distinguished observers to consider their occasional presence in the stomachs of fishes to be merely accidental.

The largest of the gregarious fishes I have as yet observed which lives, or may live, exclusively on the Entomostraca, is the early gray trout of Loch Leven and the char; but I have no doubt that on the American continent there are many admirable fishes of the natural families of Salmonidæ, Corregoni, Clupeadæ, and even others, whose food, when discovered, will be found to be Entomostraca of various species. They vary considerably in size, and seem to extend from pole to pole, consuming the organic remains which but for them might speedily infect the ocean itself.

To the geologist the facts stated in this memoir must, I think, prove of deep interest. Certain of the most productive of the gregarious fishes of past and present times depend for their existence on a class of animals exposed to destruction by chemical or other changes in the waters they inhabit: their destruction would probably involve the fish which prey on them. As regards the herring, these facts may some day explain the capriciousness in the movements of the vast shoals which visit the coasts of Scotland and other northern countries—their appearance and disappearance at various times; for the question of food must be with herrings, as with men, the all important question.

R. Knox.

Miessen House, Upper Clapton.

Calendar of Natural Phenomena observed at Purley Park, Berkshire.

By Cuthbert Collingwood, Esq., M.B., &c., &c.

January, 1855.

1. Robin Redbreast (*Sylvia rubecula*) in full song.
Starling (*Sturnus vulgaris*) sings.
Furze (*Ulex europæus*) flowers.
Shepherd's Purse (*Capsella bursa-pastoris*) flowers.
Snowdrop (*Galanthus nivalis*), leaves appear.
3. Song Thrush (*Turdus musicus*), song commences.
4. Daisy (*Bellis perennis*) flowers.
Celandine (*Ranunculus ficaria*), leaves appear.
5. Nuthatch (*Sitta europæa*), call heard.
Blue Tit (*Parus cæruleus*), note commences.
Marsh Tit (*Parus palustris*), note commences.
Missel Thrush (*Turdus viscivorus*), song commences.
6. House-fly (*Musca domestica*) appears, in a room with a fire.
8. Witches' Butter (*Tremella mesenterica*) appears.
Creeper (*Certhia familiaris*), spring note commences.
Laurustinus (*Viburnum tinus*) flowers.
9. Great Tit (*Parus major*), note commences.
10. Longtailed Tit (*Parus caudatus*), note commences.
12. Nipplewort (*Lapsana communis*) flowers.
13. Groundsel (*Senecio vulgaris*) flowers.
14. Fish begin to rise.
15. Up to this time the weather has been remarkably mild and spring-like: to-day it changed to frost.
16. Lark (*Alauda arvensis*), song commences.
Dandelion (*Leontodon taraxacum*) flowers.
17. Green Field Speedwell (*Veronica agrestis*) flowers.
Buxbaum's Speedwell (*Veronica Buxbaumii*) flowers.
White Dead-nettle (*Lamium album*) flowers.
Chickweed (*Stellaria media*) flowers.
18. Hazel (*Corylus avellana*) flowers.
Annual Meadow-grass (*Poa annua*) flowers.
Banded Snail (*Helix fasciata*) comes abroad.
Pied Wagtail (*Motacilla Yarrellii*) first seen.
(During the night there was a heavy fall of snow, the effects of which were immediately visible, as follows.)

19. Mallards (*Anas boschas*) and Teals (*Anas crecca*) arrive on our waters.
Wren (*Troglodytes europæus*), song commences.
20. Great, Solitary or Double Snipe (*Scolopax major*) seen.
21. Canada or Cravat Goose (*Anser canadensis*) taken on our waters.
Wigeon (*Anas Penelope*) and Coot (*Fulica atra*) arrive.
22. Goldeneye (*Fuligula clangula*) seen.
23. Common Gull (*Larus canus*) seen.

Remarks.—The first fifteen days of this month have been remarkably mild, and more like the weather that we should look for in the beginning of April than in January. All nature rapidly advanced: the robin, which had, as usual, been singing all through Christmas, was joined, on New-Year's Day, by the starling, which sang magnificently in my chimney on that day, but which, however, has not continued through the month. On the 3rd the song thrush commenced, preceding the missel thrush, which usually takes the lead in the year, by two days; the tits, of which five species are here common, followed in rapid succession; and six or seven plants were already in flower by the 15th: on that day frost began; nevertheless, a day or two after, two species of Veronica opened their petals, not unaccompanied by other flowers; and it is remarkable that on the 18th, the earth being then frost-bound, the banded snail woke from his winter sleep and marched about in the hedge, two months before his usual time, and doubtless soon to retire again. On the night of the 18th a fall of snow occurred, which was immediately followed by a tribe of wild fowl, consisting of mallards, teals, wigeons, coots, goldeneyes, and other Anatidæ, of which I have no authentic account; and it is worthy of notice that on this very morning, when stress of weather drove hither these hardy birds, the pigmy wren essayed his first spring ditty. On the 21st a pair of the rare solitary snipe alighted near this house; and the following day (another fall of snow having occurred in the night) the lockman brought down a fine specimen of the Canada or cravat goose, which I examined: it weighed 9 lbs., and presented no marks of having escaped from a domesticated state, although I cannot affirm that it had not done so. Other arrivals of Anatidæ have taken place during the latter days of the month; and the last two days have been marked by unusual severity of weather, snow having fallen almost without intermission. As the ground has been more or less covered with snow since the 18th, and it now lies several inches, and in some places several feet deep, it has been impossible, during that time, to mark the progress of vegetable life. Indeed, animal life has scarcely advanced, and for some days even the robin has been silent; but to-day (February 1st), after two days' incessant snow and a night of uncommon severity, the robin and the wren are singing briskly, and they are also joined by the harsh but *new* voice of the bunting (*Emberiza miliaria*). The river (Thames) is to-day, in many parts, frozen over. A friend shot close by, and submitted to my inspection, two female examples of the scaup duck (*Fuligula marila*), a truly oceanic species, which is not common, and is still more rarely found so far from the sea.

February, 1855.

1. Bunting (*Emberiza miliaria*), song commences.
Scaup Ducks (*Fuligula marila*) shot.
2. Large flocks of Wild Geese (*Anser segetum*) appear.
Hedge Accentor (*Accentor modularis*), song commences.
3. Fieldfares (*Turdus pilaris*) and Redwings (*T. iliacus*) migrate further South.
4. Bittern (*Botaurus stellaris*) shot on the banks of the Thames.
5. Green Woodpecker (*Picus viridis*), laughing note commences.
Primrose (*Primula vulgaris*), leaves appear.
6. Snowdrop (*Galanthus nivalis*) flowers.
Corn Marygold (*Chrysanthemum Segetum*) flowers.
7. Scarlet Peziza (*P. coccinea*) appears.
10. Butcher's Broom (*Ruscus aculeatus*), red berries appear.
17. Hoopers or Whistling Swans (*Cygnus ferus*) visit us.
20. Ring Dove (*Columba palumbus*) coos.
21. Partridges (*Perdix cinerea*) pair.
22. Yew (*Taxus baccata*) flowers.
23. Japan Quince (*Cydonia japonica*) leafs.
N.B. After a smart fall of snow this morning the frost broke up.
24. Yellowhammer (*Emberiza flava*), song commences.
Winter Aconite (*Helleborus hyemalis*) flowers.
25. Chaffinch (*Fringilla cœlebs*), song commences.
Squirrel (*Sciurus vulgaris*) leaves his winter retreat.
Gnats (*Culices* and *Chironomi*) appear in clouds.
Thrush (*Turdus musicus*) resumes his song, after seven weeks' intermission.
White or Barn Owl (*Strix flammea*) screeches.
26. Skylark (*Alauda arvensis*), song commences.
Hoopers or Whistling Swans (*Cygnus ferus*) return northwards.

26. Snipe (*Scolopax gallinago*) last seen.
Wild Duck (*Anas boschas*) last seen.
27. Bean Geese (*Anser segetum*) return Northward.
Pansy (*Viola tricolor*) flowers.
28. Bunting (*Emberiza miliaria*) resumes his song, after four weeks' intermission.
Redwings (*Turdus iliacus*) and Fieldfares (*T. pilaris*) return from their second migration.
First Lepidopterous insect (*Hibernia* ——— ?) seen on the wing.

Remarks.—The month of February has, in many respects, differed considerably from the preceding month in atmospheric influences, and their effects upon animal and vegetable life. The first two-thirds of January were comparable with ordinary March and April weather, and the last fortnight, although more seasonable, only paved the way for binding up the whole month of February in the iron bonds of an unusually severe winter. Instead of bathing in the river, as I did during the first half of January, the corresponding part of February saw me skating on its frozen surface. Nature, which advanced with too rapid strides in January, has, in February, been unduly repressed. A frozen month of drifted snow has enveloped the earth for six weeks, in some places so thickly that the absence both of light and air has materially checked the growth of the early spring plants; so that vegetation, in those places where a botanist would look for its gradual advance—in the hedgerows and woods—has been almost at a stand-still; the very lanes themselves being, in many instances, impassable from the accumulated snow. The effects of this inhospitable covering over the otherwise bountiful table of Nature have been manifest on that class of animals which chiefly look to it for supplies. The granivorous birds have been hard pressed by hunger; and the insectivorous birds have felt even more keenly the common destruction of their natural food, and the difficulty of obtaining those supplies which yet remained. It is remarkable that, contrary to the popular impression, the supply of "hips and haws," which form the subsistence of a large number of birds, especially in default of other food, was this winter extremely scanty, in fact, almost entirely deficient. Under these circumstances, it is not surprising that, during the late hard weather, birds should not unfrequently have been found dead, having perished from the failure of supplies, and the consequent severity of the *cold*, which alone would not have affected them. During the whole time that the frost has lasted, those birds which had previously been in song have intermitted their notes, being doubtless too much occupied in the earnest search for a precarious subsistence to indulge in those buoyant feelings which induce song. This applies to all *ground-feeders*, with scarcely an exception; but it is worthy of remark that the busy tribe of the tits (*Paridæ*), which find their food principally in the crevices of the bark of trees, have been active and busy throughout, and have enlivened the plantations with an unceasing volley of sprightly notes. The same remark applies to the nuthatch (*Sitta europæa*), whose loud and business-like whistle is never wanting, for the same reason. A curious effect of the unwonted keenness of the past winter was exhibited by the fieldfares and their congeners, the redwings: they have performed a distinct double migration. On the 2nd of the month, while travelling to Oxford, I saw large flocks of these birds in the fields all the way along; but since that day, for a space of nearly four weeks, I have looked in vain for a single one. I conjectured that they had sought a more southern and congenial climate, and I anticipated that when the frost broke they would return; and, indeed, yesterday (February 28) they *did* return, and reappeared in our meadows in vast numbers and in good condition.

The month opened with the most wintry aspect that can well be imagined. For the last forty-eight hours in January the snow had been incessant and the nights severe; but neither frost nor snow had as yet influenced the condition of our passerine birds, and the bunting (*Emberiza miliaria*) opened the month with his harsh note: his example was followed the next day by the hedgesparrow (*Accentor modularis*), and it is curious, as an example of the varying influence of the seasons on different classes of birds, that at the moment I was arrested by first hearing his note I was engaged in watching the majestic flight of twenty-one wild geese (*Anser segetum*), as, driven from their usual haunts by the freezing of the waters, they sailed in one long, unbroken line, about 100 yards overhead; but the birds just mentioned soon felt the chilling influence, and ceased singing almost as soon as they had begun; nor were they joined by any new voices until the latter part of the month. On the night of the 3rd a remarkably rapid thaw, succeeded by a no less rapid frost, in the space of a few hours produced a curious result: every tree, from the largest branches to the smallest twigs, was in the morning encased in a transparent tube of ice, which glittered beautifully in the sunlight. For two or three days it continued to thaw under the influence of the sun, freezing again at night, so that by the 6th the snow had almost disappeared, disclosing a few flowers which flourish despite the frost; but among them was one which I should little have expected to find in such circumstances: in an open turnip-field, half-covered with frozen snow, I plucked a handsome and fully-expanded blossom of the corn marigold (*Chrysanthemum Segetum*), a plant which we are accustomed to see blooming in July among the ripening grain. On the 7th a considerable fall of snow took place, which has not yet entirely disappeared: from that day until the 23rd was an unceasing frost, and the most trying part of the whole winter to the feathered tribes: the days were all unusually fine, and the nights clear and bright, the thermometer generally sinking below 20° F. The number of wild fowl visiting our streams have not increased in proportion to the severity of the weather, and that for two reasons:—in the first place, the country being densely populated, there was little chance of rest for birds, which every one who possesses a gun considered fair game; and, secondly and chiefly, the river and other waters have long been almost entirely closed up by ice, so that they are forced to proceed further in search of open waters, which are necessary to their existence; nevertheless, we have had some variety of them, as follows:—

More than one flock of wild swans (*Cygnus ferus*) have passed this way. The first flock of these magnificent birds I had the good fortune to see; it consisted of six, one of which was shot near Reading, and sold by the shooter for one guinea; the remaining five, when I saw them, were hovering over a small piece of open water near the lock, attracted there by the presence of a pair of tame swans (*Cygnus olor*). These birds are very unusual here, and are only seen in the hardest winters: the lockman tells me, however, that he has seen them settle in the meadows, and feed there for a whole morning, during which time he was deterred from shooting them by the idea that they were only the tame swans of the neighbouring ornamental waters.

Wild Geese. I am not sure whether more than one species has visited us this year, viz., the Bean Goose (*Anser segetum*), but numerous large flocks have been seen.

Wild Duck (*Anas boschas*). The earliest and latest wild fowl that have been observed, and also the most common.

Wigeon (*Anas Penelope*). Not unfrequent.

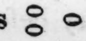
Teal (*Anas crecca*). A very few at the commencement of the frost.

Scaup Duck (*Fuligula marila*). Two or three have been shot close by.

Goldeneye (*Fuligula clangula*). Several of these handsome birds have been taken: the last, a most beautiful male specimen, was shot on the 21st, and is stuffed and placed with others in the hall of this house.

Pochard (*Fuligula ferina*). Six of these delicious birds, only inferior to the canvas-back duck of America, were killed in one afternoon, on the 16th, by a gentleman, a quarter of a mile from this house. There have been other species, but these are all I have myself seen. The genus Fuligula, to which the last three belong, consists of marine ducks of diving habits, which are not usually seen inland, unless pressed by strong necessity.

The occurrence of the bittern (*Botaurus stellaris*) should be noticed, as it is a bird fast becoming rare; and, moreover, in the part of the river where it was shot, the cover of reeds, &c., is very scanty for so large and shy a bird.

It will be seen, in my Calendar for the past month, that from the 7th to the 17th but one observation was registered. This was to be expected during such a dead season, and, in default of other and more active sources of remark, I found not a little interest in the study of what may be called the "Ichnology of the snow." In so soft a material the gentlest footfalls, though unheard, leave an impression which betrays the track of many a watchful animal. Of all the impressions thus produced, by far the most numerous, and by far the most universal, were those of the wild rabbit (*Lepus cuniculus*), with a sprinkling of hares (*L. timidus*), the two hind-feet parallel, and one fore-foot a little advanced before the other, thus  . There is not a spot, however exposed, where these wary animals do not venture at night: their marks were almost as numerous at the threshold of my door and under my window as among their burrows in the copse. Out in the open fields the cautious grimalkin had stalked, in search, I suppose, of feathered prey; and pairs of minute depressions at regular intervals showed where the little hardy shrew (*Sorex araneus*) had made a short journey; but the birds presented by far the greatest variety of footsteps. The marks of the passerine birds in the shrubberies were comparatively rare: they seem to have confined themselves more to the trees; but in the stubble fields, for acres in extent, not a square inch was left unimpressed by the busy feet of flocks of larks. Almost as numerous, but more circumscribed, were the foot-prints of the starlings. Some few largish footmarks were left by the rooks, but very few, considering their numbers. A zigzag series of impressions, for nearly a furlong in extent, showed where a covey of partridges had been feeding; while perhaps a dozen impressions of three large spreading toes here and there by the river-side, betrayed the spot where a heron (*Ardea cinerea*) had alighted. The indistinct impressions left by the webbed feet of the ducks (*Anatidæ*) readily distinguished them from the clearer marks of the moorhen (*Gallinula chloropus*), although of the same size, and situated precisely in the same position at the water's edge.

About the 20th the soft cooing of the ring dove and the pairing of the partridges gave indications of approaching spring, and these symptoms were followed by a sudden and rapid thaw on the 23rd, occurring immediately after a short but heavy fall of snow. All at once the face of Nature was changed: on the 25th the thermometer stood at 48° F., and the air, after having been so long cold and bracing, felt oppressively warm. The effect was magical; the snow, except where it had drifted deep, had disappeared; the groves resounded with the voices of birds, rejoicing in the downfal of the iron rule of Winter; but all the rest were almost drowned by the hitherto unheard, but now universal, song of the musical chaffinch; the little squirrel quitted his retreat, and leaped nimbly from bough to bough; the thrush, after seven weeks of mournful silence, ushered in the evening with his tuneful voice; and even the stillness of night was broken, for the first time, by the shrill and prolonged scream of the white owl. The business of pairing has scarcely commenced yet; the domestic birds, the fowl and pigeon, it is true, have broods a month old: the jackdaw (*Corvus monedula*) made attempts to pair early in January before the frost set in, but their domestic arrangements were of course interrupted: the only birds which have *really* paired are the hardy partridges; but their example will quickly be followed by the rooks, which have suffered much during the late hard weather, but which for the last day or two have shown that restless activity which foreshadows the important business of the season of love.

In conclusion, I trust I may say, "The winter is over and gone, and the time of the singing of birds is come;" and I hope that before I close the account of the present month I may be able to announce the arrival of the first of our summer birds of passage, the pretty and amusing chiffchaff.

March, 1855.

1. Hive Bee (*Apis mellifica*) comes abroad.
Rooks (*Corvus frugilegus*) pair.
Missel Thrush (*Turdus viscivorus*) resumes his song, after seven weeks' interval.

1. Field Spiders appear in numbers.
Redwings (*Turdus iliacus*) and Fieldfares (*T. pilaris*) last seen.
2. Seven-spotted Ladybird (*Coccinella 7-punctata*) appears.
Elder (*Sambucus nigra*) leafs.
Common Honeysuckle (*Lonicera periclymenum*) leafs.
3. House-flies (*Musca domestica*) appear in rooms without a fire.
Spurge Laurel (*Daphne Laureola*) flowers.
4. Spiders shoot their webs.
Rooks build.
5. Cuckoo-Pint (*Arum maculatum*) unfolds its leaves.
Holly (*Ilex aquifolium*) mined by the larva of Phytomyza aquifolia, a Dipterous insect.
6. Alder (*Alnus viscosa*) flowers.
Gossamer (*Aranea aëronautica*) appears.
Water Vole, Water Rat (*Arvicola amphibius*) comes abroad.
Tufted Duck (*Fuligula cristata*) visits us.
7. Starling (*Sturnus vulgaris*) resumes his song.
Greenfinch (*Coccothraustes chloris*), song commences.
8. Jay (*Garrulus glandarius*) pairs.
9. Wallflower (*Cheiranthus fruticulosus*) flowers.
10 and 11. Heavy snow.
13. White Willow (*Salix alba*), catkins open.
14. Lesser Periwinkle (*Vinca minor*) flowers.
15. Arbor-vitæ flowers.
16. Goldilocks (*Ranunculus auricomus*) flowers.
17. Lungwort (*Pulmonaria officinalis*) flowers.
Woodlark (*Alauda arborea*), song commences.
18. Gooseberry (*Ribes grossularia*) leafs.
Aspen (*Populus tremula*) flowers.
19. Polyanthus (*Primula polyantha*) flowers.
Common Ladybird (*Coccinella variabilis*) appears.
20. Goldencrested Wren (*Regulus auricapillus*), song commences.
Primrose (*Primula vulgaris*) flowers.
Brimstone Butterfly (*Gonepteryx Rhamni*) appears.
Stock Dove (*Columba œnas*) coos.
Scarlet Satin-mite (*Trombidium holosericeum*) appears.
21 *et seq.* E. winds and sleet.
21. Diving Duck (*Fuligula* ——— ?) last seen.
23. Ivy (*Hedera Helix*), berries ripen.
24. Song Thrush (*Turdus musicus*) builds.
25. Dog's Mercury (*Mercurialis perennis*) flowers.

25. Wood Strawberry (*Fragaria vesca*) flowers.
26. Lesser Celandine (*Ranunculus Ficaria*) flowers.
Woodlouse (*Oniscus asellus*) appears.
Gray Wagtail (*Motacilla boarula*) last seen.
27. Very heavy fall of snow in the night.
29. Coltsfoot (*Tussilago farfara*) flowers.
31. Goldfinch (*Carduelis elegans*), song commences.
Ivy-leaved Speedwell (*Veronica hederifolia*) flowers.

Remarks.—The struggles of regenerated Nature in spring to regain the victory over the grave of winter have been this month unusually protracted and severe: for a time it has seemed as though the new-born season had established its dominion, when suddenly the icy clutch of its expiring predecessor has been felt in all its severity, and although we well know which must ultimately prevail, yet up to near the close of the month there appears but small advantage on either side. Indeed, the month of March has been singularly transitional; although it "came in," contrary to the popular adage, "like a lamb," yet its lamb-like qualities did not long endure, except, indeed, in one respect—that, namely, of yielding abundance of wool. On the 10th and 11th, after some fair, spring-like weather, there suddenly came a fall of snow, so heavy and long-continued, and so unaccompanied by wind, that the surface of the earth presented the most perfect and beautiful snow-scene we have had this winter: it all disappeared, however, in one day (the 12th), and after another interval of ten days, during which we enjoyed some lovely days (especially the 20th), the 21st ushered in a cold and violent easterly wind, with abundance of sleet, and the waters were frozen for several successive nights. Still the spring recovered itself sufficiently to show its smiles on the 26th, when, lo! as if in revenge, the night of the 27th brought the heaviest fall of snow with which this winter has favoured us: so heavy was it that had it not melted as fast as it fell it would have laid much deeper on the ground than from any previous fall. The last day of the month, however, gives promise that spring, assisted by the advancing year, will soon shake off the mantle of winter. I am thus particular in giving a summary of the weather, because the welfare and advancement of animal and vegetable life so much depend upon it: of the two animated kingdoms, however, the vegetable has suffered far more this month than the animal, and its effects upon it are far more enduring. The impetus given to animal life by the dissolution of the long frost in the latter part of February has never been interrupted, but for a day or two at a time: vegetation, however, during the whole month, has made but very slender advances; on the whole, it is now at least one month behind the usual period in an average year; in many instances it has, to all appearance, been stationary for weeks together: thus, the common snowdrop, which, during the whole of February and the greater part of March presented the same aspect, is still in full bloom, although the first spring bird of passage has made its appearance; the buds of the box tree (*Buxus sempervirens*) I have watched for full six weeks, and during that time they have undergone no perceptible change, nor are they apparently any nearer opening now than they were in the middle of February; the blushing buds of the Japan quince (*Cydonia japonica*) were apparently ready to burst at the beginning of the month, but they have not yet opened. On the other hand, those early builders, the rooks, commenced operations on the 4th instant, only four days later than last year, and the chiffchaff appeared with his sprightly note by the 1st of April, rather before the average time, and in like manner with other birds. Those insects also that I have observed have not made their appearance much after the usual time.

It is easier to note the arrival of birds than their departure; and I, who make up my list at the end of each month, may be led, for a time, into the assumption that a bird has taken its departure, whereas it may yet reappear after an interval. Thus, in my calendar for February, I wrote, "26. Wild duck last seen," supposing from the apparently settled state of the weather that we should see them no more; but during the past month they have frequently appeared, and even up to the last hour of the month: I flushed a brace towards midnight on the 31st, as I was walking along the banks of the river by moonlight; indeed, I am assured that this species occasionally remains with us, and breeds in the deep ditches near the river; but not only have the common species been seen from time to time, but on the 6th we were visited by a species hitherto, this season, new to us: a party of nine tufted ducks (*Fuligula cristata*), the usual companions of those species previously enumerated, spent the morning upon the river, and one specimen was procured. Even as late as the 21st an oceanic duck of this genus (Fuligula) was seen, but that I think will be the last. I should remark that, in my list of Anatidæ last month, I omitted the cravat goose (*Anser canadensis*), which, it will be remembered, was killed here on the 20th January, making altogether four genera and ten species which have come under my immediate notice this winter. A little before Easter, some years since, the man who still occupies the lock-house shot a pair of birds which puzzled him: although very unusual-looking birds he did not take them to any connoisseur, but, after a little debate with his wife, they agreed to make an Easter Sunday dinner of them, which they accordingly did. These birds proved to be a pair of the beautiful and rare white spoonbills (*Platalea leucorodia*), and, much to their chagrin, the worthy couple found that they had made a dear repast, although obtained for nothing: an esteemed friend of mine, who then lived in this house, and who possesses a beautiful collection of British birds, stuffed with his own hand, would willingly have given five guineas to have added so valuable a desideratum to them; but I believe they did not even save *their spoons.*

In making observations on Natural History it is necessary that the observer be extremely careful, lest he be led astray by one of the numerous fallacies to which he is especially liable, and to set down with caution any extraordinary circumstance, making due allowance for sources of error. I am led to this remark by something which occurred about the middle of the month: observing a number of dead fishes accumulated in a certain reach of the river, I was led to examine more closely, when I found that in a space of about 150 yards there were 182 dead fishes. Now and then I took from the water a fish which floated by, but still gasped for breath, although incapable of motion. All these fishes were more or less covered with a sort of fungoid growth, which, I was well aware, generally proved fatal when it appeared upon them, gradually spreading all over them, and destroying their vital functions. Moreover, on a further examination, I found that, with the exception of a very few dace (*Leuciscus vulgaris*) and bleak (*L. alburnus*), all these fishes were roach (*L. rutilus*), and not a single perch (*Perca fluviatilis*) was to be seen among them, although these last fish are very plentiful in the river. On a *primâ facie* view of this evidence I was inclined to believe that this disease had been *epidemic* among the roach, or was at least confined to the genus Leuciscus. In this mind I made further inquiries, and at length elucidated the mystery. On asking the fisherman who rents the water whether he had thrown away any fish, he told me as follows: having received an order for a number of live roach he netted the required quantity, and placed them in his live-box, to be ready when sent for. One night the box broke its moorings and disappeared: it was upwards of three weeks before it was discovered, and during that time the fish had become what the fishermen aptly enough call "furred," the almost inevitable result of the confinement of too great a number of fish in a small space for too long a time: as they were nearly all dead he threw them away into the river, and they had floated down and collected in the spot where I saw them. The nature of the disease, for disease it is, after all, is, I believe, that of a parasitic fungus, and the only account of it I ever met with is in an early number of the 'Illustrated London Almanac,' perhaps ten years ago. I was sorry to see in the tank at the Crystal Palace, last week, a fine pike lying at the bottom "furred" and dead. I may mention further a remarkable fact, and one that should be known, namely, that the presence of a barbel (*Barbus vulgaris*) or two will *prevent* the furring of fish in confinement.

In further confirmation of what I advanced previously, I may state that sheep have been remarkably prolific this spring. Those lambs which the farmers designate *stock* or grass lambs, and which are born generally early in March, or about two months later than the *house* lambs, have been wonderfully numerous. In a flock of 300 ewes, belonging to a farming friend, 120 produced doubles, and there were besides a considerable number of *threes:* nor is this a peculiar case, but it is, I believe, the general good fortune of the breeders this spring. But if the farmers may congratulate themselves on a good lambing season, their complacency has a limit. There is an old adage, "A cold March and a crop of wheat;" but the same gentleman assures me that in examining his wheat-fields, a week or two ago, he was chagrined to see that the violent and cold winds had laid bare the roots of the young wheat-plants, and exercised such a deleterious influence upon them, in that tender state, that he looks forward to their produce being an utter failure. I trust, however, that either he is too readily alarmed or that this accident is far from being general.

All our indigenous birds, with a very few exceptions, are now in full song. These exceptions are somewhat singular: in the first place, ever since I have been here I have never seen or heard a single linnet (*Linota cannabina*), a bird usually common; neither have I yet *seen* a goldfinch (*Carduelis elegans*), although I have once heard him: both these birds are well known here, however, and I cannot account for their absence, which I can only regard as temporary. But it is remarkable that the blackbird, which usually commences his song in February, has not yet been heard: they are often enough *seen*, although not in the usual numbers, which I attribute to their having been greatly thinned by the protracted frost: I have not unfrequently found them dead. The rook also, I have no doubt, suffered greatly, and were much reduced in numbers; an establishment of thirty-seven nests in one part of our grounds, which were occupied last year, is this spring entirely deserted. I shall be anxious to see whether the lateness of the spring will have any effect in retarding the arrival of our summer birds of passage: there is such an intimate relation between vegetables and animals, as regards the means of subsistence, whether directly or indirectly, through the insect world, that I can hardly expect to see them return punctually; nevertheless, the first of them, the chiffchaff (*Sylvia hippolais*), of whose advent I spoke in my last, made himself very distinctly heard this morning, which is rather before the average time. The behaviour of the fieldfares and redwings has most puzzled me: it will be remembered that they made a second migration early in February, and returned on the 28th: on that day and the next (March 1st) large numbers were seen in our meadows, but since then *none* all through the month, although these species do not usually leave us till the middle of April.

But the ornithologists' month *par excellence* has now commenced; and its occurrences, to which I look with the liveliest interest, shall be duly forwarded to the 'Zoologist.'

C. Collingwood.

Purley Park, April 1, 1855.

Toads long known to be Enemies of the Hive-Bee.—At the meeting of the Entomological Society on the 5th of March last, I was much gratified by the observations which were read on the animals destructive to hive-bees; but more particularly so with Mr. Muskett's observation that "it is no doubt well known that the common toad will sit at the entrance of the hive and devour the bees, one after another, as they come within reach of his tongue." This not only confirmed a similar statement made known to the Society upwards of twelve months ago, but it appeared to treat the circumstance as one well known to bee-keepers, or at least as one respecting which Mr. Muskett had no doubt whatever; but he proceeded to state, in his communication, a fact which did appear singular—namely, that of the common woodpecker devouring bees in great numbers at the mouth of the hive: this appeared to Mr. Muskett to be a new fact in bee-history; that of the toad was new and interesting to Mr. Westwood. Alas! "there is nothing new under the sun." I have before me a quaint old book intituled 'Profit and Pleasure United; or, the Husbandman's Magazine; being a Treatise on all kinds of Domestic Cattle, on the Improvement of Land, and on Gardening: to which is added Directions for the Encreasing and Preserving of Bees.' The latter part of this title tells us at once that the author, "J. Smith, Gent.," was aware that they had enemies: this we shall see presently was undoubtedly the fact of the case. The article on the honey-bee is a very short one, but full of information; it commences thus:—"The Bee, though a small creature, and by many numbered amongst Insects, is extreamly Advantagious to his Nurisher in returning abundance for the little he receives." Our author, like a practical man, thoroughly earnest in his purpose, begins with directions for procuring your bees: to store yourself with bees, he says, there are three manner of ways—"Buying them, Taking wild Swarms, or making them by Art:"

then follow directions for knowing which swarms are to be selected when purchasing, and most likely to be profitable to their nourisher: next, "To store your Self with Wild Bees, Take such as Breed in Clefts of Oaks, or other Trees, in Fields, Forrests or Wildernesses, or in rocks, or Ruins of Castles or Churches:" "To find them out, set a little Box with a small hole in it, near the Water-side, whither you perceive the bees to resort, and when many have entered, for the Sugar and Honey put therein, stop up the hole, and let one out, follow him as far as you can see him, then let out another, following him likewise, and so a Third, till by their flying directly (for so they will) to the place of their abode, you find them out." Admirable ingenuity! and so there were honey-bees to be seen in clefts of trees, in rocks and ruins, in J. Smith's time (1704). I never met with more than one swarm, in a wood near Barnet—doubtless one that had escaped its "Nurisher." Our author proceeds:—"Having found them, smoak them out, and settle them by the ringing of any Brass Vessel." It is to be regretted that no directions are given for "making them by Art;" but here follows a list of "all which are *utter Enemies* to the Bees"—the toad, redbreast, woodpeckers, moth, hornet, lizard, swallow, sparrow, spider, butterfly, serpent and stork. First and foremost, our author places the toad; and the list, it will be seen, includes the woodpecker, mentioned as destructive to bees. In what manner some of the "utter enemies" are prejudicial to the bee I am not prepared to say, nor does our author afford any information on the subject: he emphatically denounces the whole host as "utter enemies." The essay concludes with directions for taking the honey from the hives, and the management of the swarms; on this head one direction is admirable, and deserves to be quoted—"If the Master-Bee, or King, be too apt to lead the swarm abroad, clip his wings, and then, not daring to trust them, he will stay at home"! I cannot do better than conclude, in the words of the author, "And thus much shall suffice for the ordering of Bees, from whose labour rises great Profit to most Kingdoms."—*Frederick Smith; April* 12, 1855.

A Word on the Use of Initial Capitals to Specific Names.—We are agreed on using initial capitals for genera, but we have no law as to initial capitals for species; for we cannot certainly reckon as a law that draft of a bill which was sent down to us from the Upper House, *videlicet*, the British Association, and which we, the Representatives of the People, threw out, *nemine contradicente*. Now, having no law, every one does exactly as he pleases; and not only are no *two* entomologists consistent with each other, but no *one*, as far as my knowledge extends, is consistent with himself. It is difficult to believe or understand the trouble which this diversity of practice gives to an editor, more especially should it so fall out that his contributor, having steadfast faith in his own critical sagacity, demands to see a proof; for then the said contributor, being in absolute command of a ship that has no rudder, and purring complacently over the unwonted authority he is enjoying, is sure to assume the printer to be in error, and incontinently to alter every small letter to a capital, and every capital letter to a small one. It is with a view to relieve entomologists of this critical labour that I suggest this simple rule—As all specific names must be substantives or adjectives, let every substantive (nominative or genitive), and no adjective, have an initial capital. One exception only occurs to me, but *exceptio constat regulam*; it is when a man's name is converted into an adjective, as Metterbacheriana or Abildgaardana,—I don't much envy these insects or their godfathers,—then the capitals must of course be preserved as signboards to testify to future generations that it is mortal men have been thus immortalized; otherwise, the *cui bono* of these ponderous monuments of genius, like that of their fellows on Salisbury Plain, must grievously puzzle philosophers yet unborn.—*Edward Newman.*

Gonepteryx Rhamni double-brooded.—Touching the question whether Gonepteryx Rhamni be double-brooded, no one, I presume, can deny that there are at least two (if not more) flights of the insect in the course of the year; and this perhaps may be all that Mr. Hawker meant by saying that it is "double-brooded." Certain it is that the insect appears on the wing in the early spring, and again later in the year, generally in August, according to my own experience, or the end of July. In the 'Butterfly Collector's Vade Mecum,' "spring, beginning of June, and in autumn" are stated as the periods of its flight. The Rev. F. O. Morris says, "There are two broods, one in May, the other in the autumn. Many of the autumnal brood live through the winter, and are to be seen in the spring, even so early sometimes as February and March." "These early specimens," say Humphreys and Westwood, "have survived the winter, and produce eggs, from which a fresh brood of butterflies is produced in May, and another in the autumn, some of which last again survive the winter." Time was when I used to suppose that all the early vernal specimens were such as had hybernated, or lived through the winter in the winged state; but in this opinion I stood corrected by a practical entomologist, who directed my attention to the perfectly fresh and brilliant condition in which some, at least, of the vernal specimens appeared, which showed, he said, that they could not have hybernated, but must have emerged from the chrysalis at that early season. If this be so,—if there are two different periods of the year at which G. Rhamni comes forth from the chrysalis,—is it not an insect, which, in the language of collectors, is styled "double-brooded?" I well remember being once called to account by a talented naturalist for using the term "double-brooded" as applied to an insect which makes its appearance at two different times of the year. The expression, I was told, was ambiguous and incorrect. I merely replied that I believed it was perfectly intelligible to all collectors, and the term constantly employed by them to express an insect of which there are two flights during the year. Nobody doubts that this is the case with G. Rhamni, whether the specimens have hybernated, or come fresh from the chrysalis in the spring. Probably some individuals fall under one description, and some under the other. I am surprised, therefore, to find that the idea of G. Rhamni being double-brooded should be new to Mr. Newman, Mr. Doubleday and other eminent Lepidopterists (Zool. p. 4706). I will add that Haworth says, under Papilio Rhamni, "Mas et fem. vivant per hyemem. Femina ova ponit tempore vernali." Though, strange to say, both in his 'Prodromus' and in 'Lepidoptera Britannica,' he merely gives the beginning of June as the time of the insects appearing.—*W. T. Bree; Allesley Rectory, May* 12, 1855.

Capture of Gastropacha ilicifolia on Cannoch Chase.—I hasten to inform you that two specimens of Gastropacha ilicifolia were this day captured on Cannoch Chase, near Rugeley, Staffordshire, by my friend Arthur Partridge, Esq. The insects were in repose on an old oak post, not many yards from the spot in which the first English specimen was taken by my brother, W. S. Atkinson, Esq., in May, 1851. Not being myself an entomologist I must content myself with mentioning the fact.—*H. G Atkinson, Curate of Rugeley; April* 27, 1855.

Occurrence of Notodonta carmelita in Kent.—A single specimen of this rare insect was taken at West Wickham by Mr. Standish, jun., on the 13th of May, and a second by myself on the 14th; the last-mentioned was a female in fine condition.—*William Machin; 35, William Street, Globe Fields, Mile End, May* 15, 1855.

29 JU 55

ENTOMOLOGICAL SOCIETY.

N ADDRESS delivered at the ANNIVERSARY MEETING of the ENTOMOLOGICAL SOCIETY OF LONDON, on Monday, January 22nd. By EDWARD EWMAN, President.

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CONTENTS.

Fishes.—On the Food of certain Gregarious Fishes, *R. Knox, M.D., F.R.S.E., &*
4709.

Calendar of Natural Phenomena observed at Purley Park, Berkshire, *Cuth*
Collingwood, M.B., &c., &c., 4725.

Insects.—Toads long known to be Enemies of the Hive-Bee, *Frederick Smith, E*
4738. A Word on the Use of Initial Capitals to Specific Names, *Edw*
Newman, 4739. Gonepteryx Rhamni double-brooded, *Rev. W. T. Bree*, 47
Capture of Gastropacha ilicifolia on Cannoch Chase, *Rev. H. G. Atkinson*, 47
Occurrence of Notodonta carmelita in Kent, *William Machin*, 4740.

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I shall feel obliged to any one who will communicate to me, by Letter, such insta
of the Capture of the more uncommon Species as may have fallen under his notice,
as many additional Localities (with dates) as can possibly be supplied.

J. F. DAWSO

The Woodlands, Bedford, May 12, 1855.

BRITISH ANTHICI.

HAVING prepared a Paper on the British Species of the Ge
ANTHICUS, *Payk*, which will probably appear shortly either in the 'Zoolo
or 'Transactions,' I shall be obliged to any one who will furnish me with the Local
of any of these, and also if any one will send me Specimens, of the identity of whic
is in doubt, I shall be happy to examine and name them, and return the same to
faithfully.

J. F. DAWSO

The Woodlands, Bedford, May 12, 1855.

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